Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2017

Marking Scheme

Agricultural Science

Higher Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

Introduction

General points

- The marking scheme is a guide to awarding marks.
- Examiners must conform to this scheme, and may not allow marks for answers outside the scheme.
- In many cases only key phrases are given in the marking scheme. These points contain the information and ideas that must appear in the candidate's answer in order to merit the assigned marks.
- The descriptions, methods and definitions given in the marking scheme are not exhaustive and alternative valid answers are acceptable.
- If an examiner determines that a candidate has presented a valid answer but there is no provision in the scheme for accepting that answer, then the examiner must first consult with his/ her advising examiner before awarding marks. In general, if an examiner is in any doubt whether a particular answer is correct they should consult their advising examiner before awarding marks.
- The detail required in any answer is determined by the context, the phrasing of the question, and by the number of marks assigned to the answer in the examination paper. This may vary from year to year.
- Words, expressions or statements separated by a solidus (/) are alternatives that are equally acceptable for a particular point. A word or phrase given in brackets is an acceptable alternative to the preceding word or phrase. Note, however, that words, expressions or phrases must be correctly used in context and not contradicted and where there is evidence of incorrect use or contradiction, the marks may not be awarded.
- In general, names and formulas of elements are equally acceptable. However, in some cases where the name is specifically asked for, the formula may be accepted as an alternative. This will be clarified within the scheme.

Cancelled answers

- If the only answer offered is cancelled ignore the cancelling and mark as usual.
- If an answer is cancelled and a second version of the answer is given, you should accept the cancellation and award marks, where merited, for the un-cancelled version only.

- If two un-cancelled versions of an answer are given to the same question or part of a question, mark both and accept the answer that yields the greater number of marks. You may not, however, combine points from both versions to arrive at a manufactured total.

Conventions

- The mark awarded for an answer appears in the marking scheme next to the answer on the right hand side.

- Where there are several parts in the answer to a question, the mark awarded for each part appears as e.g. **3(4)**. This means there are three parts to the answer, each part allocated 4 marks.

- Award unit marks separately e.g. if an answer merits three 3-mark units, write three separate '3's, under each other, in the first column in the right-hand margin of the answer book.

- The answers to subsections of a question may not necessarily be tied to a specific mark e.g.
  there may be three parts to a question - (i), (ii), (iii), and a total of 12 marks allocated to the question. The marking scheme might be as follows: **6 + 3 + 3**. This means that the first correct answer encountered is awarded 6 marks and each subsequent correct answer is awarded 3 marks.

- Square brackets and/ or *italics* are used where the examiner's attention is being drawn to an instruction relating to the answer or to some qualification of the answer.

- Examiners should write the total mark for each question at the beginning of the question, beside the question number, and circled.

- The cumulative total should be written in the bottom right-hand corner of each page on which a question total appears.

- All blank pages should be marked to indicate they have been inspected.

Q 1 Answer any six parts 6(10)

(a)	(i) *Species:* Italian (or perennial or hybrid) ryegrass/ (red or white) clover/ peas (or beans or named legume)/ barley (or oats) ***Any two*** (ii) *Reasons:* ***One matching reason from each of two choices made above*** *Ryegrasses:* High productivity **or** digestibility **or** palatability **or** fast growing *Clovers, peas, beans:* Nitrogen fixation **or** high in protein **or** digestibility **or** productivity or palatability *Oats, barley:* Productivity	**2(4)** **+** **2(1)**
(b)	(i) *Biological control:* Control of pests (or weeds or diseases)/ using predators (or parasites or infectious agents or another living thing) ***Two points*** (ii) *Examples:* e.g. Aphid-ladybird/ red spider mite-whitefly/ mouse-cat (or dog)/ slug (or snail)-duck (or goose)/ aphid-parasitic wasp/ vine weevil-nematode ***Any two***	**2(4)** **+** **2(1)**
(c)	(i) *Structural differences:* *Monocot (Dicot):* Narrow leaves (broad leaves)/ parallel veins (net or reticulate veins)/ flower parts in 3s or multiples of (flower parts in 4s or 5s or multiples of)/ vascular bundles scattered (vascular bundles in a ring)/ fibrous roots (tap root)/ seeds have one cotyledon (seeds have two cotyledons)/ vascular tissue in root in a circle (root vascular tissue star shaped) ***Any two*** (ii) *Examples:* e.g. Monocot: grass (or named grass or named cereal or other valid) Dicot: potatoes (or peas or beans or sunflower or other valid)	**2(4)** **+** **2(1)**
(d)	*Rock types:* (i) *Marble:* Metamorphic (ii) *Granite:* Igneous (iii) *Basalt:* Igneous	**6+3+1**
(e)	*What determines amount of animal ration protein:* Age/ sex/ production target/ body condition score/ health/ type or breed of animal ***Any three***	**6+3+1**
(f)	*Leaf structure for photosynthesis:* Thinness for diffusion/ large surface area to trap light/ more chloroplasts in palisade (upper) layer for increased photosynthesis/ stomata for entry of air (or CO_2)/ vascular tissue for transport/ cuticle to conserve water/ spongy mesophyll (or air spaces) to allow diffusion ***Any three***	**6+3+1**

(g)	*Dental formulae:* (i) *Sheep:* $\frac{0033}{3133}$ [*Allow* $\frac{0033}{4033}$] (ii) *Pig*: $\frac{3143}{3143}$ Both formulae must have the order of incisors, canines, premolars, molars clearly stated	**6 + 4**
(h)	(i) *N-fixing bacteria:* Rhizobia (ii) *Legumes other than clover:* Peas/ beans/ vetch/ furze (or whin or gorse) or other valid ***Any two***	**6+3+1**
(i)	(i) *BCS:* Degree of fat on the body **or** lean to fat ratio/ scale of 1 - 5 **or** 1 – 9 (ii) *BCS for dairy cow:* Before calving: 3.0 - 3.5 At mating: 2.5 - 3.0	**2(4)** **+** **2(1)**
(j)	*Reproductive hormone functions* (i) *FSH:* Promotes follicle development **or** egg development **or** sperm production (ii) *Progesterone:* Inhibits ovulation **or** inhibits lactation **or** inhibits labour **or** maintains pregnancy **or** synchronised breeding **or** lambing out of season (iii) *Testosterone:* Development of male characteristics (or described) **or** sperm production	**6+3+1**

Q 2

(a)	(i) *How water held in soil:* Adsorption (hygroscopic): held by attraction between negative charges on clay and positive charges on (polarised) water molecule Capillary (action): water held in small pores by capillary forces *NB 'capillary' must be mentioned at least once to get both points* (ii) *Benefits of artificial drainage:* Lowers water table/ less risk of poaching (or compaction)/ increases aeration/ warmer soil/ improved crop growth (or yield)/ easier to cultivate (or earlier cultivation)/ benefits earthworms/ controls liver fluke/ increased nutrient uptake ***Any two***	**3+2** **3+2** **2(3)**
(b)	(i) *How soil acidity increases over time:* Rainfall/ crop growth/ animal excretion/ fertilisers/ acid rain/ manures (or slurry or OM)/ pine needles ***Any three*** (ii) *Matching mechanisms of acid increase:* Leaching of $Ca^{(2+)}$ (or $Mg^{(2+)}$)/ incorporation of base-forming elements into plant tissues/ urine is acidic/ acidic components in some fertilisers/ continuous effect of rain with acidic component/ decomposition of organic matter **or** acidic component in slurry/ pine needles are acidic ***Any three*** (iii) *Effects of increased acidity on crops:* Poor nutrient uptake (or immobilisation of minerals)/ inhibition of N fixation/ unsuitable pH for most crops (or lower yield) ***Any two***	**3(2)** **3(2)** **2(2)**
(c)	*Experiment – to show cation exchange in soil:* High pH soil/ filter/ wash with KCl (soln)/ test filtrate (leachate) for $Ca^{(2+)}$/ using ammonium oxalate/ white ppt. is positive/ repeat until negative (for $Ca^{(2+)}$)/ test for $K^{(+)}$/ using sodium cobalt nitrate/ purple colour is positive ***Any six***	**2(4)** **+** **4(2)**

Q 3 Option one

(a)	*Requirements for winter housing for beef weanlings:* Slats/ straw (or mats)/ 1.4 m^2 floor space/ 7 m^3 air space/ ventilation (or draught-free)/ clean water/ feeding space ***Any four***	**2(6)** **+** **2(2)**
(b)	(i) *Winter feeding programmes:* Silage in both for winter 1 and winter 2 **or** hay and silage for winter 1 and silage for winter 2/ less or no concentrates for winter 1 **or** more concentrates for winter 2/ valid reason for either difference (ii) *Target weights:* *Year 1 winter housing:* 200-220 kg *Year 2 winter housing:* 450-480 kg *Slaughter:* 550-600 kg	**6** **+** **2(2)** **4** **+** **2(1)**
(c)	*Slurry* *vs* *FYM* (i) *Nutrient value:* Higher N **or** less OM **or** faster acting — Lower N **or** more OM **or** slower acting (ii) *Storage:* Tank — Dungstead **or** slab (iii) *Spreading method:* Slurry spreader or injection method — Muckspreader **or** by fork (iv) *Disadvantages of spreading:* Soil compaction **or** pollution **or** disease spread **or** odour **or** weed dispersal — Soil compaction **or** odour **or** pollution **or** weed dispersal **or** disease spread **or** slower to return to grazing	**2(2)** **2(2)** **2(2)** **2(2)**

OR

Q 3 Option two

(a)	*Potato cultivation:* (i) *Soil suitability:* Deep/ well drained/ sandy loam or other valid soil type/ pH 5.5-6.0/ stone free ***Any two*** (ii) *Sowing:* 10 cm below ridge/ 20-35 cm spacing/ 40,000-60,000 per ha./ potato planter/ February to April/ sprouting for earlies ***Any two*** (iii) *Weed control:* Earthing up/ shading/ herbicide/ manual weeding/ scuffling ***Any two*** (iv) *Storage:* Ventilated or correctly stacked/ frost free/ dry/ no vermin/ darkness/ growth inhibitors/ low temperature ***Any two***	**3 + 1** **3 + 1** **3 + 1** **3 + 1**
(b)	*Cereal cultivation:* *Name:* Barley **or** wheat **or** oats **or** maize (i) *Climate:* Warm/ moist/ dry **or** sunshine ***Any two for any named crop*** (ii) *Disease:* Fungal disease (or viral disease or disease named)/ certified seed/ spray/ biological control ***Any two*** (iii) *Harvest date:* July to September (iv) *Yield:* Barley: 6-8 t per ha for spring (8-9 t per ha for winter) Wheat: 7-8 t per ha for spring (9-11 t per ha for winter) Oats: 6-7 t per ha for spring (7-8 t per ha for winter) Maize: 15-20 t per ha of dry matter	**3** **3 + 1** **3 + 1** **3** **2**
(c)	(i) *Cereal ripening changes:* Bleached colour of straw/ head parallel to stem (barley only)/ straw dry/ grain hard/ moisture content decreases below 20%/ grain falls off/ top leaves dead (For maize: silks dry/ silks dark brown/ kernel has clear liquid/ ears plump) ***Any three*** (ii) *Tests on harvested grain:* ***Any two*** <u>Moisture test:</u> Find mass of sample/ dry at 100 °C/ find mass loss/ OR Moisture meter/ calibrate/ number of readings/ average <u>Screenings test (test for purity)</u>: Find mass of sample/ separate impurities/ calculate % pure seed/ <u>Hectolitre mass</u>: Fill container of known volume (or chondrometer) with grain/ find mass of grain/ calculate for 100 litres/	**4 + 2(2)** **2(2+2(1))**

	Protein test: Find % nitrogen/ use Kjeldahl test/ multiply by 6.5 (or Pynes's method/ titrate with NaOH) Hagberg test: Test for flour quality/ measures viscosity (or flow rate or use viscometer)/ of wheat flour and water mixture/ Germination test: Count seeds/ provide all conditions necessary for germination/ count number that germinate/ Mycotoxin test: Toxic substances/ from moulds/ detected by chromatography/ 1,000 grain mass: Count a number of grains (or seeds)/ find the mass/ calculate mass for 1,000 grains (or seeds)/	

Q 4 Laboratory or field tests Any two parts

(a)	*Compare digestibility of whole and rolled cereal grains:* Two cattle of similar size or breed (or of known mass)/ separate/ equal ration/ one whole and one rolled/ valid time interval/ examine dung (or find mass of animals again)/ compare presence of grains (or mass of animals)/ result (or conclusion)/ repeat ***Any six*** OR Two equal samples of cereal grain/ one whole and one rolled/ added to two test tubes/ add water and amylase to each/ place in waterbath at 37 °C/ test for starch (or presence of reducing sugar (or glucose or maltose))/ using iodine for starch (or Benedict's (or Fehling's)) for reducing sugar)/ correct conclusion ***Any six***	**6(4)**
(b)	*Determine quality of pit or bale silage:* <u>Leaf to stem ratio:</u> Find mass of sample of silage/ separate the leaves from the stems/ find mass of two dishes/ put leaves in one and stems in the other/ find mass/ get ratio of leaves to stem/ correct conclusion (more leaf or better DMD) OR <u>pH test:</u> Squeeze (or crush) sample of silage/ collect liquid/ add distilled water/ test for pH with indicator or pH meter/ record result (pH 3.8 to 4.2)/ correct conclusion OR <u>To get DM content:</u> Find mass of sample of silage/ record/ dry at 100 °C/ get mass again and repeat drying until mass is constant/ record final mass/ calculate % DM/ correct conclusion (16-20% DM) OR <u>For good quality silage (poor quality):</u> colour/ yellow-green (black-brown)/ smell/ slight or sharp (sweet or sour)/ taste/ sharp acidic (not sharp acidic)/ feel/ firm (mushy)/ squeeze/ releases a small amount of liquid or none with two hands (liquid released with one hand)	**6(4)**
(c)	*Compare capillarity in two soils:* *Sandy soil and clay soil/ each into an open ended glass tube/ cotton wool plug in base/ stand tubes in water/ minimum of 1 hour/ water rises higher in clay or lower in sand/ capillarity greater in clay [**compulsory point*]	**6(4)**
(d)	*Measure rate of transpiration:* Potometer/ leafy plant/ cut under water/ angled cut/ insert in potometer/ seal/ insert air bubble/ correct conditions (for transpiration)/ time bubble movement/ repeat	**6(4)**

Q 5

(a)	(i) *Qualitative tests on milk:* Methylene blue test/ resazurin test/ TBC/ SCC/ thermoduric bacteria/ temperature/ antibiotic (e.g. Delvo test)/ added water ***Any two*** *Quantitative tests on milk:* Sediment/ % water (or % solids)/ % lactose/ butterfat test/ % protein/ % minerals/ TBC/ SCC/ thermoduric bacteria/ temperature ***Any two*** (ii) *Description of any one quantitative test:* <u>Gerber butterfat test:</u> Butyrometer/ 10 cm^3 sulphuric acid/ 10.75 cm^3 milk/ 1 ml amyl alcohol/ stopper butyrometer/ shake until red colour/ centrifuge at 1200 rpm for 4 minutes/ adjust fat column with key/ read result (from scale) <u>Adulteration of milk with water</u>: Pour milk into graduated cylinder ⅔ of volume along sides/ lower lactometer gently/ read lactometer at the top of meniscus/ repeat the procedure with milk sample with added water/ lactometer sinks deeper in watered-down sample OR Find the freezing point of the milk/ cryoscope/ if freezing point is greater than - 0.5 °C/ water has been added to the milk <u>% water or % solids:</u> Record the mass of a milk sample/ dry at 100 °C/ to a constant mass/ find % water/ correct result or correct conclusion <u>To find the % ash (or % minerals) in milk:</u> Dry a milk sample/ record the dry mass/ burn the milk until it reaches a constant mass/ calculate the % ash/ correct result or correct conclusion <u>To find the % lactose in milk</u>: Allow milk to sour (or coagulate the protein and fat)/ take a sample of the milk whey/ place a sample on a refractometer or polarimeter/ record %/ repeat/ find the average <u>To find the % protein</u>: Find the % nitrogen in the milk/ using the Kjeldahl method/ multiply the % nitrogen by 6.5 (or using Pyne's method/ titrate with NaOH)/ to find % protein	**2(2)** **2(2)** **4(2)**
(b)	(i) *Lowland sheep breeds:* Galway/ Texel/ Suffolk/ Border Leicester/ Blue-faced Leicester or any valid ***Any two*** *Breed characteristics:* *Galway*: Large **or** white wool **or** polled **or** wool on forehead *Texel*: White face **or** polled **or** excellent conformation **or** excellent carcase quality **or** short wool **or** white wool **or** wide face **or** head free of wool *Suffolk*: Excellent conformation **or** short wool **or** dark wool **or** black head **or** black legs **or** polled *Border Leicester*: Upright ears **or** polled **or** white wool **or** long wool **or** large *Blue-faced Leicester*: Upright ears **or** roman nose **or** blue skin **or** polled **or** white wool **or** long wool **or** large (ii) *Why crossbred ewes used in lowland enterprise:* Hybrid vigour/ good mothering ability/ good carcase quality/ prolific/good milk production ***Any two***	**2(2)** **One point each from any two breeds 2(3)** **2(3)**

(c)	(i) *Reproductive efficiency:* Number of calves weaned per 100 cows mated (ii) *Factors affecting reproductive efficiency:* BCS/ heat detection/ calving interval/ age of cow/ health of cow/ culling rate/ age at first calving/ diseases linked to fertility/ calf mortality/ bull/ timing of service/ AI/ diet/ duration of oestrus/ dam access to calf (or post-birth care)/ breed ***Any three***	**4** **3(4)**

Q 6

(a)	*How DMD changes as grass grows:* Leafy stage high DMD (or high sugar)/ sugar converted to cellulose (or soluble to insoluble carbohydrate) as plant grows/ DMD drops/ heading date DMD very low/ drops 0.5% per day (after heading date)/ increased fibre (or stem) ***Any four***	**4(4)**
(b)	*Methods to maintain high grass DMD for longer:* *Method (effect)* Rotational grazing (recovery time)/ topping (new growth (or tillering))/ (N) fertiliser or slurry (new foliage)/ late-flowering grasses (delays drop in DMD)/ PRG (high DMD late in season)/ mixed grazing (high DMD)/ early and late strains (different heading out dates) ***Any four***	**4[2(2)]**
(c)	*How ruminant stomach suited to digestion of grassland plants:* Rumen/ cellulose digested (by rumen flora) Reticulum/ regurgitation for chewing the cud Omasum/ water removed Abomasum/ digestion completed (by gastric juices)	**2(2)** **2(2)** **2(2)** **2(2)**

Q.7.

(a)	(i) *Performance testing:* Comparing records of an animal's performance (or FCR, or growth rate, or conformation)/ with the records of similar animals kept under the same conditions (to identify superior animals) *Progeny testing:* Comparing the records of the performance of an animal's offspring/ with the offspring of other animals kept under the same conditions (to identify superior breeding stock) (ii) *Characteristics for selection of replacement heifers:* Fertility/ calving ease/ docility/ beef traits/ feed intake/ conformation/ growth rate/ FCE/ good potential milk yield/ healthy udder and teats (or good health)/ longevity/ good cull value ***Any three***	**2(2)** **2(2)** **3(3)**
(b)	(i) *Incomplete dominance:* Neither allele dominant (or co-dominant or of equal dominance) **or** both expressed in the phenotype (or resulting in an intermediate trait)/ roan shorthorn cattle or pink flower or other valid (ii) *Alleles:* Alternative forms of a gene/ tall-dwarf or other valid (iii) *Continuous variation:* Characteristic controlled by a number of genes (or genes produce a range within a phenotype)/ stem length or milk yield or other valid	**3+2** **3+2** **3+2**
(c)	Gametes WS Ws wS ws WS WWSS WWSs WwSS WwSs Ws WWSs WWss WwSs Wwss wS WwSS WwSs wwSS wwSs ws WwSs Ww ss wwSs wwss ***All gametes correct*** ***All offspring genotypes correct*** *Phenotype probabilities* (i) Albino coat: 4/16 (ii) Bent hair: 4/16 (iii) Albino coat and bent hair: 1/16 (iv) Wild type coat colour and bent hair: 3/16	**4** **4** **2** **2** **2** **2**

Q 8 Any two parts

(a)	*Carbon cycle:* ***6 marks for a diagram with all the following in correct relationship to each other*** Carbon dioxide in air **and** photosynthesis **and** animals consume plants **and** death (or decay) of organisms **and** respiration **and** fossil fuels (or limestone (carbonates)) **and** combustion (or by rain) ***3 marks for a diagram with any one of the above absent or any arrow absent or in a wrong direction*** *Diagram labels or written account* Carbon absorbed by plants in photosynthesis/ carbon assimilated into biomolecules (or named biomolecule)/ plants consumed by animals/ assimilation point for animals if not already quoted for plants/ death (or decay) of organisms/ microorganisms (or named)/ carbon released by organisms in respiration/ carbon trapped in fossil fuels (or in limestone (or carbonates))/ carbon released from fossil fuels (or from plants) by combustion (or from limestone by rain) ***Any six***	**6, 3, 0** **6(3)**
(b)	(i) *Principal structural features of insects:* Exoskeleton (or chitin)/ 6 legs (or jointed legs)/ 3 body regions/ head and thorax and abdomen/ compound eyes/ antennae/ spiracles/ (most have) wings ***Any four*** (ii) *Insect pests and the damage they do:* e.g. Cabbage white butterfly (or caterpillar if adult not named)/ larva (or caterpillar) if not already given eats leaves/ of cabbage e.g. Green bottle (or blowfly) (or maggot if adult not named)/ larva (or maggot if not already given) eats flesh/ of sheep	**4(3)** **3(2)** **3(2)**
(c)	*Distinguish between terms:* (i) *Flushing:* Stocking heavily on bare pasture (or put on a low plane of nutrition)/ release on to better pasture (or put on a higher plane of nutrition) prior to mating *Sponging:* Insertion of progesterone-impregnated sponges into ewe's vagina/ to synchronise breeding **or** for breeding (or lambing) out of season (ii) *Aspect:* Direction (south or north)/ a field is facing *Topography:* Landscape shape (or lie of the land)/ sloped or flat (iii) *Zoonoses:* Animal diseases/ transmissible to humans *Notifiable diseases:* Must be reported (to relevant authority)/ quarantine/ national importance/ animals slaughtered (iv) *Stem tuber:* (Modified stem) with buds/ food store/ more starch (than rhizome) *Rhizome:* (Modified stem) with nodes/ spreads horizontally/ less starch (than tuber) **Two points per term for any three pairs**	**3{2[2(2)]}**

Q 9 Any four parts Scientific explanations

(a)	*Environmental temperature and weight gain in pigs:* Correct (or critical) temperature gives better FCR/ food consumed goes to body mass rather than to maintain body temperature/ reach slaughter mass faster/ correct temperature for one specified house/ in low temperatures they consume too much feed (or eat less at higher temperature) ***Any three***	**3(4)**
(b)	*Dense conifer planting in forestry:* Taller (or straighter) trees **or** increased competition/ free from knots (or better quality timber)/ prevents weeds/ provides thinnings/ provides shelter belt/ allows for failed trees ***Any three***	**3(4)**
(c)	*Low earthworm population in intensely cultivated soils:* Machinery damage/ exposed to predation during cultivation/ low OM/ increased use of chemical sprays/ compaction (or poor aeration) ***Any three***	**3(4)**
(d)	*Grit in free-range poultry digestive tracts:* (Birds have) no teeth/ gizzard/ muscular/ (grit) grinds down/ hard coat of (cereal) grains (or allows digestion of (cereal) grains)/ improves shell quality ***Any three***	**3(4)**
(e)	*Deep ploughing podzolic soils:* Breaks iron pan/ improves drainage/ improves aeration/ restores soil nutrients (or recovers leached minerals)/ allows penetration of roots ***Any three***	**3(4)**

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